57. $\perp$ $\boxed{xy+2x-y=0}$ $\parallel$ $2x+y=0.$

slope $=-2$

normal

$xy'+y+2-y'=0$

$xy'-y'=-y-2$

$y'(x-1)=-y-2$

$x=-1$, $y=-1$; $x=3$, $y=-3$

$$y'=\boxed{\frac{-y-2}{x-1}=\frac{1}{2}}$$

slope of tan

$-y-2=\frac{1}{2}(x-1)+2$

$$\boxed{y=-\frac{1}{2}(x-1)-2}$$

normal lines

$y=-2(x+1)-1$

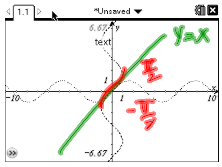
$y=-2(x-3)-3$

Sep 30-10:01 AM

3.8 Derivatives of inverse trig functions

Derivative of the Arcsine

$y=\sin^{-1}(x)$ *means* $x=\sin(y)$



restrict the range to make y=arcsine(x) a function

$y=\sin^{-1}\frac{1}{2}$ means $\frac{1}{2}=\sin y$

$y=\frac{\pi}{6}$

$\sin\frac{\pi}{6}=\frac{1}{2}$ $\quad$ $\sin\cancel{\frac{5\pi}{6}}=\frac{1}{2}$

$\sin^{-1}\frac{1}{2}=\frac{\pi}{6}$ $\quad$ $\sin^{-1}\frac{\sqrt{3}}{2}=\frac{\pi}{3}$

$\sin^{-1}\frac{1}{2}=30^\circ$ $\quad$ $\sin^{-1}1=\frac{\pi}{2}$

$\sin^{-1}0=0$

Oct 4-6:55 PM

$y=\sin^{-1}x$ $\quad$ $\frac{dy}{dx}=?$ $\quad$ $\frac{1}{\sqrt{1-x^2}}$

means

$x=\sin y$ $\quad$ $\sin^2y+\cos^2y=1$

$1=y'\cdot\cos y$ $\quad$ $\cos^2y=1-\sin^2y$

$y'=\frac{1}{\cos y}=\frac{1}{\sqrt{1-x^2}}$ $\quad$ $\cos y=\sqrt{1-\sin^2y}$

$\cos y=\sqrt{1-x^2}$

$$\boxed{\frac{d}{dx}\sin^{-1}u=\frac{du}{dx}\cdot\frac{1}{\sqrt{1-u^2}}}$$

Sep 30-10:28 AM

$$\frac{d}{dx}\left(\sin^{-1}x^2\right)=2x\cdot\frac{1}{\sqrt{1-x^4}}$$

$$\frac{d}{dx}\left(\sin^{-1}\frac{\sqrt{x}}{3}\right)=\left(\frac{3\cdot\frac{1}{2}x^{-\frac{1}{2}}-\sqrt{x}\cdot 0}{3^2}\right)\cdot\frac{1}{\sqrt{1-\left(\frac{\sqrt{x}}{3}\right)^2}}$$

$$=\frac{x^{-\frac{1}{2}}}{6}\cdot\frac{1}{\sqrt{1-\frac{x}{9}}}=\frac{1}{6\sqrt{x}}\cdot\frac{1}{\sqrt{1-\frac{x}{9}}}$$

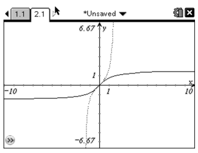
$\frac{1}{3}\sqrt{x}$

$\frac{1}{3}\cdot\frac{1}{2}x^{-\frac{1}{2}}$

Oct 4-7:09 PM

Derivative of the Arctangent

$$\boxed{\frac{d}{dx}\tan^{-1}u=\frac{du}{dx}\cdot\frac{1}{1+u^2}}$$



What is the range of y=Arctan(x) ?

Oct 4-7:14 PM

A particle moves along the x-axis so that its positon at any time t>=0 is $x(t)=\tan^{-1}\sqrt{t}$ What is the velocity of the particle when t=16?

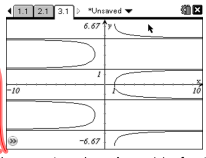
$$v=x'=\frac{1}{2}t^{-\frac{1}{2}}\cdot\frac{1}{1+(\sqrt{t})^2}$$

$$v(16)=\frac{1}{2\sqrt{t}}\cdot\frac{1}{1+t}\Big|_{t=16}=\frac{1}{136}$$

Oct 4-7:24 PM

Derivative of the Arcsecant

$$\boxed{\frac{d}{dx}\sec^{-1}u = \frac{du}{dx}\cdot\frac{1}{|u|\sqrt{u^2-1}}}$$



restrict the range to make y=Arcsec(x) a function

Oct 4-7:24 PM

$$\frac{d}{dx}\sec^{-1}\left(5x^4\right) = 20x^3\,\frac{1}{|5x^4|\sqrt{25x^8-1}}$$

$$= \frac{4}{|x|\sqrt{25x^8-1}}$$

Oct 4-7:31 PM

Derivatives of the other three

$\cos^{-1}x = \frac{\pi}{2} - \sin^{-1}x$

$\cot^{-1}x = \frac{\pi}{2} - \tan^{-1}x$

$\csc^{-1}x = \frac{\pi}{2} - \sec^{-1}x$

$$\boxed{\begin{gathered}\frac{d}{dx}\cos^{-1}u = \frac{du}{dx}\cdot\frac{-1}{\sqrt{1-u^2}}\\ \frac{d}{dx}\cot^{-1}u = \frac{du}{dx}\,\frac{-1}{1+u^2}\\ \frac{d}{dx}\csc^{-1}u = \frac{du}{dx}\,\frac{-1}{|u|\sqrt{u^2-1}}\end{gathered}}$$

Oct 4-7:34 PM

Derivative of an inverse function

If *f* and *g* are inverse functions then $g'(x) = \frac{1}{f'(g(x))}$

Oct 4-7:38 PM